Railroad Industry Perspective

NTSB PTC Symposium

March 2, 2005

Robert C. VanderClute

ASSOCIATION OF AMERICAN RAILROADS

TOMORROW. ARRIVING BY TRAIN.

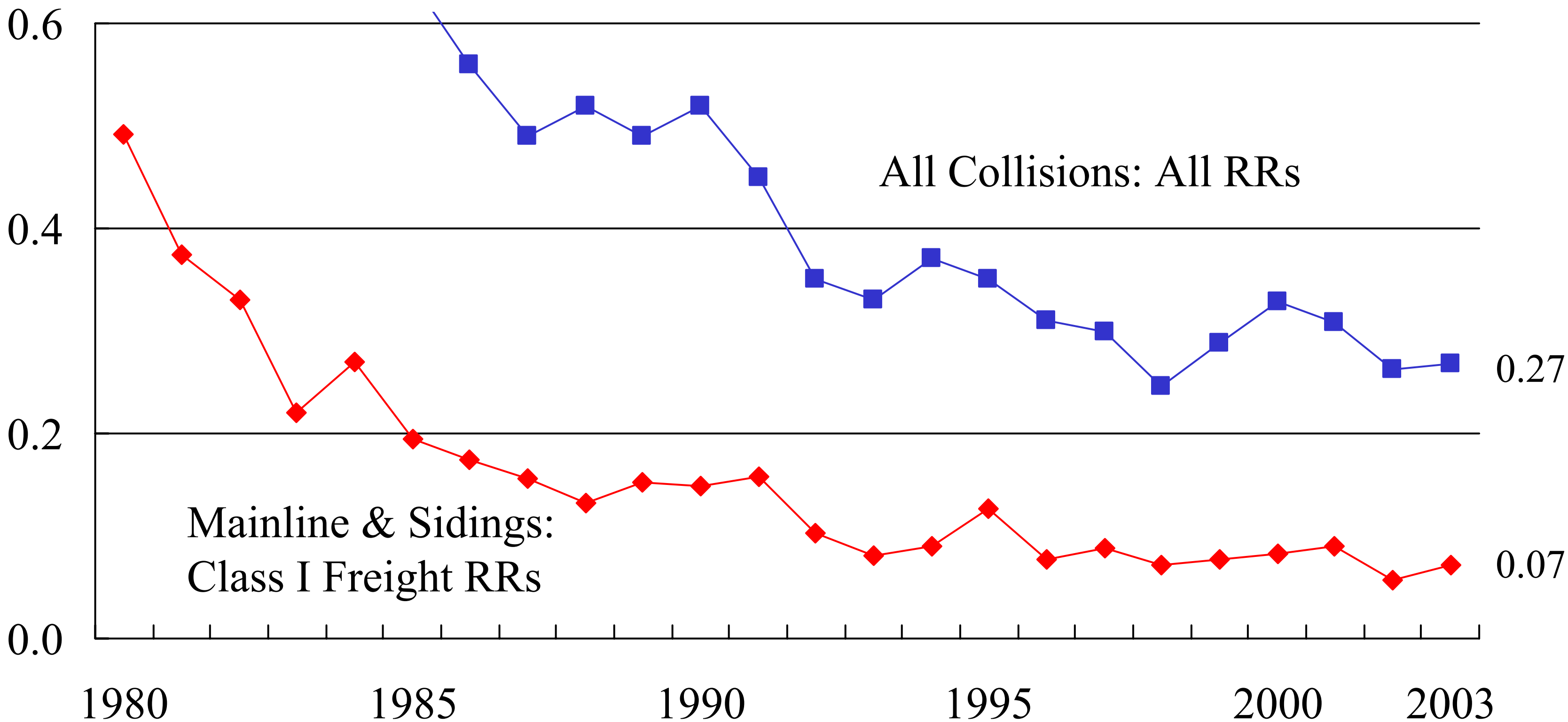
Agenda

- Overview
- Railroad Safety Performance
- Current Train Control Systems
- Overall PTC Development
- Industry Standards
- PTC Issues
- Conclusions

Overview

- PTC is defined by the PTC RSAC (included labor, FRA, industry and suppliers) as meeting the safety objectives of:
  - Preventing train to train collisions (positive train separation).
  - Enforcing speed restrictions, including civil engineering restrictions and temporary slow orders.
  - Providing protection for roadway workers and their equipment operating under specific authorities

Mainline Train Collisions per million train miles on Class I Freight Railroads have dropped 86% since 1980 and 53% since 1990



Sources: FRA, Railroad Safety Statistics Annual Report 2002, Tables 1-1, 5-6; Accident/Incident Bulletin, 1980-1996, Tables 19, 36. AAR Analysis of FRA train accident database.
FRA website: http://safetydata.fra.dot.gov/Prelim/2003/r01.htm (preliminary 2003 data)

Note: Excludes grade crossing accidents. Includes passenger train collisions on Class I freight railroads.

Some Statistics on Mainline Collisions

- Accidents numbers range from 231 in 1980 to 38 in 2003
  - From 1994-2003 numbers have varied from 60 in 1995 to 30 in 2002
- Fatalities from 1994-2003 total of 39: ranging from 7 in 1994 to 0 in 2003, average of 4
- Injuries from 1994-2003 total of 352: ranging from 71 in 2001 to 14 in 1998, average of 35

Sources: FRA, <u>Railroad Safety Statistics Annual Report 2002</u>, Tables 1-1, 5-6; <u>Accident/Incident Bulletin</u>, 1980-1996, Tables 19, 36. AAR Analysis of FRA train accident database.
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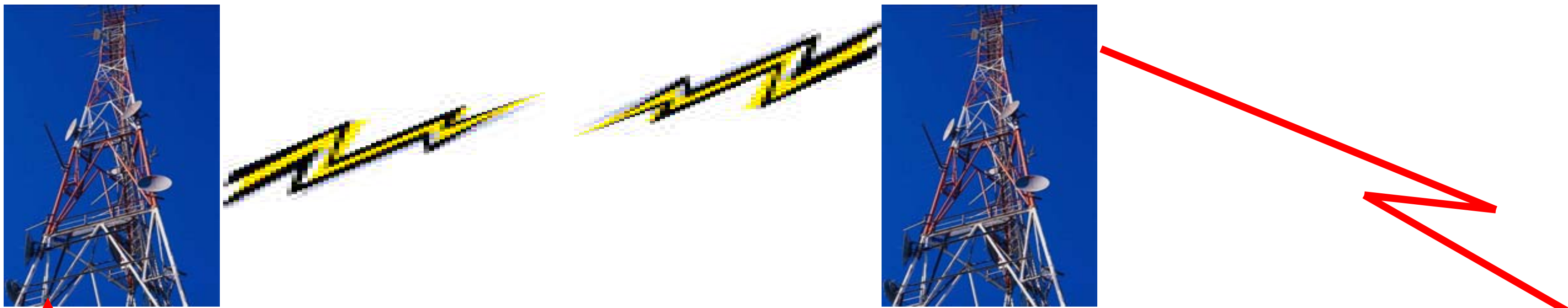
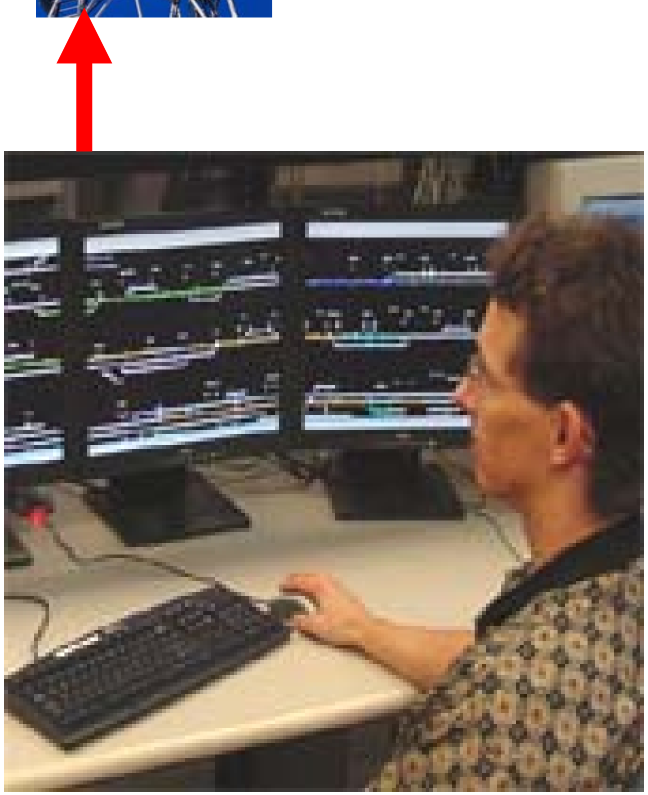
Safety Statistics/Comments/Reasons for Improvements

- Train accident rate for 2004 is lower than that for 2003 and is down 7.94% since 2001
- Not all train collisions are "PTC Preventable"
- Most prominent reasons for improvement:
  - Better training and adherence to operating rules
  - Dispatch system computerization and
  - Technology – event recorders
- Improvements should continue because of both technical and non-technical changes

Current Train Control Systems

Current Train Control System





Train Dispatcher

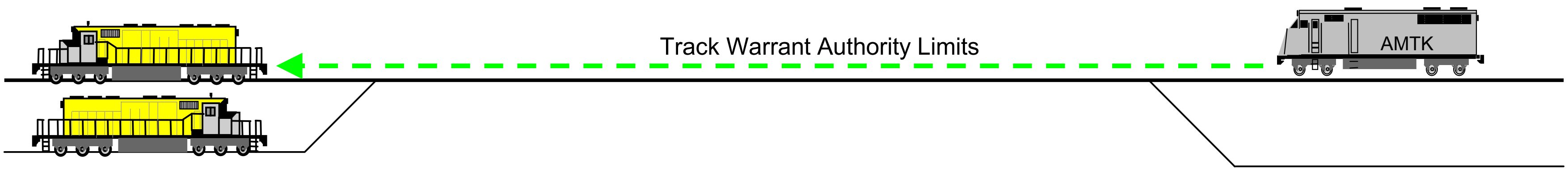
Engineer *manually* controls speed and complies with authority limits based on instructions conveyed *visually* by signal indication

Typical Train Dispatching Workstation

Most trains are dispatched from computer-based systems

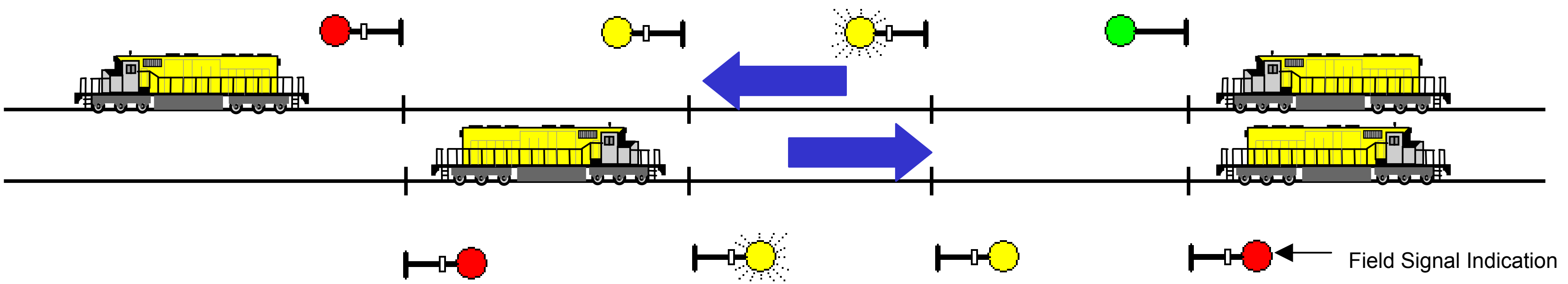
- Dispatching systems can set signals and throw switches but field signal systems provide failsafe operations
- Verbal communications with trains is by analog radio through private or sometimes public/private systems
- Compliance with rules is vested in the locomotive crew
- Record keeping is computer-based with manual backup

Dark Territory:
Track Warrant Control



- **Main Track Not Signaled**
- **Movement Authority Conveyed By Track Warrant**
- **Train separation provided by train dispatcher and train crew in compliance with operating rules**
- **Verbal communication**
- **Territory and speed limit knowledge vested in train crew (documented in timetables)**

Automatic Block Signal (ABS): Current Of Traffic



•Two Main tracks with an assigned direction of movement

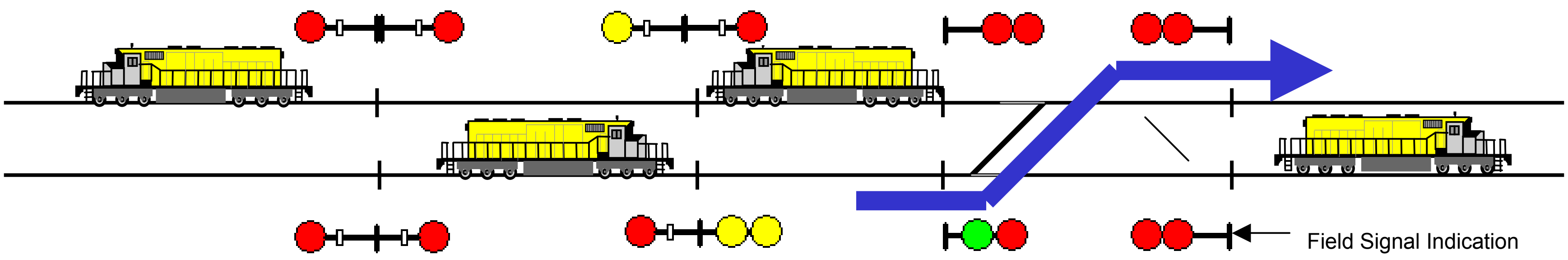
•Movement authority and speed is conveyed by signal system

•The tracks are only signaled for movement in the assigned direction.

•Train separation provided by train crew and signal system

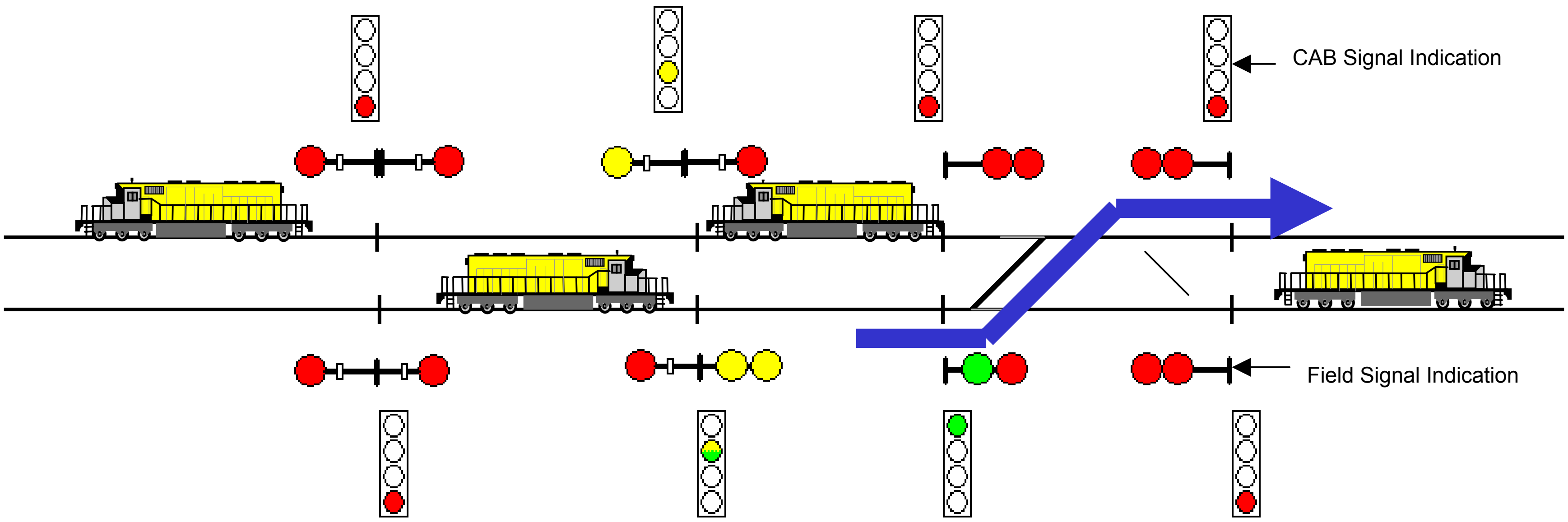
•Territory and speed limit knowledge vested in train crew (documented in timetables)

Centralized Traffic Control (CTC) or Train Control System (TCS)



- Multiple main tracks signaled for traffic in both directions
- Movement authority and speed is conveyed by signal system
- Train dispatcher controls switches and signals from distant location
- Train separation provided by train crew and signal system
- Territory and speed limit knowledge vested in train crew (documented in timetables)

CTC or TCS with Cab Signals & Speed Control



- Multiple main tracks signaled for traffic in both directions
- Movement authority and speed is conveyed by signal system
- Train separation provided by train crew and proactive speed enforcement by locomotive speed limiter
- Territory and speed limit knowledge vested in train crew (documented in timetables)

Comments on Current Train Control Systems

- Very safe and reliable – and expensive
- Have evolved from relay based to processor based systems
  - Most new systems use non-vital digital data link to/from field to dispatch
- Train control (except for cab signal system functions) is done through a set of operating rules that dispatcher and train crew follow

Requirements for Train Control Systems of the Future

- Reduce the possibility of human factor related accidents
- Provide a platform for other features such as:
  - Train handling assist
  - Advance activation of grade crossing warning systems
- Create a cost-effective system
  - Minimize the capital and life cycle costs of field control systems
  - Use standards for onboard and communications systems to avoid duplication
- Must use proven and reliable technology whose benefits clearly exceed costs

Train Control Development in Railroad Industry

- AAR's member roads have committed substantial resources to PTC pilot projects to date
  - Current costs far exceed potential benefits
    - PTC can reduce line capacity, reducing average velocity
  - FRA report show a cost/benefit ratio well under 1
  - Technology is not yet proven
- Railroads have committees and task forces developing industry interoperable standards
  - Are also working with FRA on a "Universal Onboard Platform" for some existing cab signal based train control systems

Principal PTC Projects and Development

- Systems in revenue service (oriented toward passenger systems)
  - NJT ASES – cab signal based
  - Amtrak ACSES – cab signal based
  - Incremental Train Control System
- Systems under development and testing
  - NAJPTC – Illinois Department of Transportation
  - CBTM – CSX's project in Spartanburg, SC to Augusta, GA
  - ETMS – BNSF's project on Beardstown sub in Illinois
- Railroads have spent over $225 million on PTC developments

Industry Standards Effort

Industry Standards

- Evolved from ATCS work in late 1980's and from other electronics standards e.g. wireless communication
- Have established a task force on Railway Electronics reports to Interoperable Operations and Train Control Working Committee and then to SOMC (Operating Vice Presidents)
- Currently very active process to define the standard on the Message Service
- Responds to the NTSB recommendation R-03-23 milestones and activities for completion of standards

Electronic Standards Tree

- MSRP Section K Part of Section M
  - Archive
    - **LSI Architecture**
    - **LSI Communications**
  - Railroad Communications
    - **AEI S-918**
    - **EOT S-5701**
    - **RF Coms S-5800**
    - **RCL CAI**
  - Architecture
    - **Locomotive M-590**
    - **Network**
    - Office
    - Wayside
  - Other
    - **Configuration Mgt Plan S-5700**
    - **Environment S-5702**
    - **Oper Disp M-591**
    - **Event Recorder**
  - Messages
    - **Data Dictionary**
    - Messages
      - train control
      - locomotive apps
      - other

Black bold indicates current adopted specifications

Green bold indicates specifications completed in approval cycle

Standards Milestones

- Most standards and specifications to allow for interoperable systems are completed (e.g. M-590 Locomotive Electronics System Architecture) or about to be published S-5901 Network Specification
- Will test/evaluate Message Service by early 2005 and complete specification by mid 2005

Conclusions

- PTC shows promise to reduce the risk of train collisions and overspeed derailments
- PTC is expensive and complex and has yet to show positive cost/benefit
- PTC technology is not yet proven
- Industry is working diligently on standards to provide for interoperability